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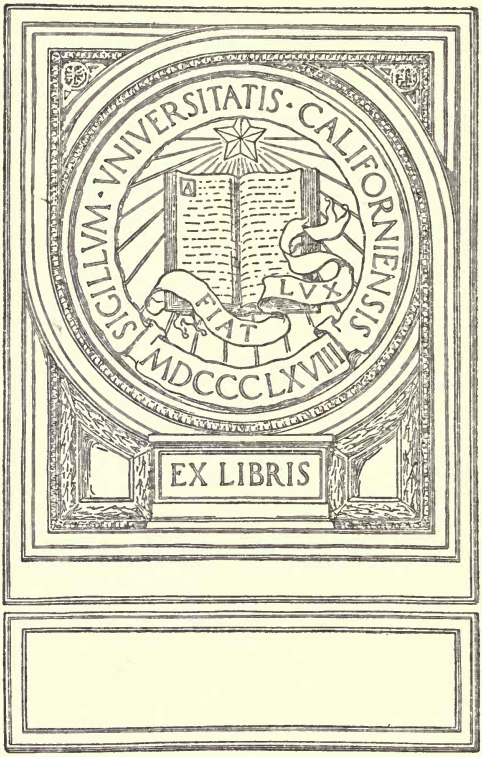

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CANADA.

A

GEOGRAPHICAL, AGRICULTURAL,

AND

MINERALOGICAL SKETCH.

Published by authority of the Bureau of Agriculture.

QUEBEC:

PRINTED AT "LE CANADIEN" OFFICE,
21, Mountain Hill, Lower Town.

1865.

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CANADA.

A GEOGRAPHICAL, AGRICULTURAL, AND MINERALOGICAL SKETCH.

It is proposed in the following pages to give a short account of the physical geography and geology of Canada, considered more especially with reference to its agricultural capabilities, and to the nature of its different soils.—To this necessarily very brief outline will be joined a notice of some of the more important natural productions of the country, chiefly those derived from the mineral kingdom. The consideration of its vegetable and animal products, except so far as the questions of manures from the fisheries, and of peat from the bogs, are concerned, will be left to another pen. For more ample details on the various matters here touched upon, the reader is referred to the Reports of the Geological Survey of the province, and especially to the large octavo volume published in 1863, and entitled GEOLOGY OF CANADA; to which the writer is indebted for most of the materials of the present sketch.

The great basin of the St. Lawrence, in which the province of Canada is situated, has an area of about 530,000 square miles. Of this, including the gulf of St. Lawrence, the river, and the great lakes, to Lake Superior inclusive, about 130,000 square miles are covered with water, leaving for the dry land of this

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basin an area of 400,000 square miles, of which about 70,000 belong to the United States. The remaining 330,000 square miles constitute the province of Canada. With the exception of about 50,000 square miles belonging to Lower Canada, and extending from the line of New York to Gaspé, the whole of this territory lies on the north side of the St. Lawrence and the great lakes.

On either side of the valley of the lower St. Lawrence is a range of mountainous country. These ranges keep close to the shores for a considerable distance up the river; but about 100 miles below Quebec where the river is fifteen miles wide, the southern range begins to leave the margin, and opposite to Quebec is thirty miles distant. From this point it runs in a more southwestern direction than the river valley, and opposite Montreal is met with about fifty miles to the southeast, where it enters Vermont, and is there known as the Green Mountain range, which forms the eastern limit of the valley of Lake Champlain. In Canada, this range, stretching from the parallel of 45° north latitude to the Gulf, is known as the Notre-Dame Mountains, but to its northeastern portion, the name of the Shickshock Mountains is often given.

The flank of the northern hills, known as the Laurentides, forms the north shore of the river and gulf, until within twenty miles of Quebec. It then recedes, and at the latter city is already about twenty miles distant from the St. Lawrence. At Montreal the base of the hills is thirty miles in the rear, and to the westward of this it stretches along the north side of the Ottawa River for about 100 miles, and then runs southward across both the Ottawa and the St. Lawrence, crossing the latter river a little below Kingston, at the Thousand

Islands, and entering New-York. Here the Laurentides spread out into an area of about 10,000 square miles of high lands, known as the Adirondack country, and lying between the Lakes Champlain and Ontario. The narrow belt of hill-country which connects the Adirondacks with the Laurentides north of the Ottawa, divides the valley of the St. Lawrence proper from that of the great lakes, which is still bounded to the north by a continuation of the Laurentides. The base of these from near Kingston runs in a western direction, at some distance in the rear of Lake Ontario, until it reaches the southwest extremity of Georgian Bay on Lake Huron; after which it skirts this lake, and Lake Superior, and runs northwestward into the Hudson Bay Territory. This great northern hill-region consists of the oldest known rock-formation of the globe, to which the name of the Laurentian system has been given, and occupies, with some small exceptions, the whole of the province northward of the limits just assigned. We shall designate it as the LAURENTIAN REGION. Over a small portion of this area, along Lakes Huron and Superior, and farther eastward on Lake Temiscaming is another series of rocks, to which the name of the Huronian system is given. But as the country occupied by these rocks is geographically similar to the Laurentian, it is for convenience here included with it.

To the south of this region the whole of Canada west of Montreal, with the exception of the narrow belt of Laurentian country described as running southward across the Ottawa and St. Lawrence Rivers, is very level. The same is true to the eastward of Montreal until we reach the Notre-Dame range of hills, already described as passing southward into Vermont, and in its north-eastern exten-

sion as bounding the lower St. Lawrence valley to the south. This valley may be regarded geographically as an extension of the great plains of western Canada and central New-York, with which it is connected through the valley of Lake Champlain. This level country to the south of the Laurentides in the two parts of the province is occupied by similar rock formations, and constitutes the CHAMPAIGN REGION of Canada, the surface of which is scarcely broken, except by a few isolated hills in the vicinity of Montreal, and by occasional escarpments, ravines, and gravel ridges farther westward.

The next area to be distinguished consists of the Notre-Dame range on the south side of the St. Lawrence which forms the belt whose course has just been described, with an average breadth of from thirty to forty miles. To the south and east of this, is a district of undulating land, which extends to the boundaries of the province in that direction. These two districts may for convenience in farther description be classed together, and they embrace the region which is generally known as the EASTERN TOWNSHIPS. By this term they are distinguished from the SEIGNIORIES, which bound them to the north and west. To the north-east however, along the Chaudiere River, some few seigniories are found within the geographical limits of this third region.

The whole of the province is well watered with numerous large and small rivers, and in the mountainous districts there are great numbers of small lakes, more than 1,000 of which are represented on the maps.

We have in the preceding descriptions divided the country into three distinct regions, and have next to consider the geological structure of these as related to the soil and to agricultural capabilities.

I.

THE LAURENTIAN REGION.

The great tract of country occupied by the Laurentian rocks has for its southern boundary the limits already assigned, and stretches northward to the boundary of the province, which is the height of land dividing the waters of the St. Lawrence basin from those of Hudson Bay. Its area is about 200,000 square miles, or six tenths of the whole land of the province. This region is composed exclusively of crystalline rocks, for the most part silicious, or granite-like in character, consisting of quartzite, syenite, gneiss and other related rocks. These are broken up into ridges and mountain peaks, generally rounded in outline and covered with vegetation. The summits in the neighbourhood of Quebec are some of them from 2,000 to 2,500 feet in height, and in other parts attain 4,000 feet or more; but the general level of this region may be taken at about 1,500 feet above the sea, although it is much less in the narrow belt which crosses the province east of Kingston. Through the hard rocks of this region run numerous bands of crystalline limestone or marble, which from their softness give rise to valleys, often with a fertile soil. The hill-sides are generally covered with little else than vegetable mould, which sustains a growth of small trees, giving them an aspect of luxuriant vegetation. But when fire has passed over these hills, the soil is in great part destroyed, and the rock is soon laid bare. In the valleys and lower parts of this region however, there are considerable areas of good land, having a deep soil, and bearing heavy timber. These are the great lumbering districts of the country,

from which vast quantities of timber, chiefly pine, are anuually exported, and constitute a great source of wealth to the province. These valleys are in most cases along the line of the bands of limestone, whose ruins contribute much to the fertility of the soil. Lines of settled country running many miles into the wilderness are found to follow these belts of soft calcareous rock.

The settlements in this region are along its southern border, and at no great altitude above the sea. In the higher parts, the rigor of the climate scarcely permits the cultivation of cereals. It is probable that no great portion of this immense region will ever be colonized, but that it will remain for ages to come covered with forests. These, if husbanded with due care, will remain a perpetual source of timber for the use of the country and for exportation; besides affording, with proper facilities for transportation, an abundant supply of fuel to the more thickly settled districts, where the forests have nearly disappeared, and where from the severity of the long winters, an abundant supply of fuel is of the first necessity. There are other reasons why this great forest-region should be protected. The vegetation, and the soil which now cover the hill-sides, play a most important part in retaining the waters which here fall in the shape of rain or snow. But for this covering of soil, the rivers and mill-streams which here take their rise, would like the streams of southern France, and of the north of Italy, be destructive torrents at certain seasons and almost dried-up channels at others. The effect of this great wooded area in tempering the northern winds, and moderating the extremes of climate is not to be overlooked in estimating the value of the Laurentian rigion; which moreover as will be shown farther on, con-

tains inexhaustible mines of rich iron ores, besides copper, lead, marbles, and other mineral substances of economic importance.

II.

THE EASTERN TOWNSHIPS.

Under this head, as already explained, is included the belt of hill-country south of the St. Lawrence, with the region on its southeast side extending to the frontier, and forming a succession of valleys, which may be traced from the head-waters of the Connecticut northeastward to the Bay of Chaleurs. It is true that the Eastern Townships, as now known, do not embrace this northeastern extension; but as it belongs to them both geographically and geologically it may be conveniently included with them.

The area whose limits are thus defined forms about one-tenth of the province. The hills of the range which traverses it are composed, like those of the Laurentian region, of crystalline rocks; but these are softer than the greater part of the rocks on the north shore, and yield by their wearing-down a more abundant soil. Some of the hills in this range attain an elevation of 4,000 feet above the sea, and the principal lakes in the valley on the southeastern side, Memphremagog, Aylmer, and St. Francis, are from 750 to about 900 feet above the sea-level. This region is well wooded, and when cleared is found in most parts to have an abundant soil, generally sandy and loamy in character, and well fitted for grazing and for the cultivation of Indian corn and other grains. Great attention is now paid to the raising of cattle, and the growing of wool, and within the last few years the best breeds of sheep have been suc-

cessfully introduced from England and from Vermont. Draining and improved methods of farming are in many parts practised, and the agricultural importance of the southern portions of this region is yearly increasing. The Eastern Townships moreover abound in metallic ores, marbles, slates, etc., which will be noticed in their place.

III.

THE CHAMPAIGN REGION.

The limits of the great plains of Canada have already been defined in describing those of the two proceeding regions. These plains, which may be called the champaign region, occupy about three tenths of the province, and are, as we have seen, divided into two parts by a low and narrow isthmus of Laurentian country, which runs from the Ottawa to the Adirondacks of New-York. To the eastward of this division, the present region includes the country between that river and the St. Lawrence, and all between the Laurentides on the north and the Notre-Dame hills on the southeast; while to the westward it embraces the whole of the province south of the Laurentian region, including the great area lying between the Lakes Ontario, Erie and Huron, generally known as the southwestern peninsula of Canada. The whole of this region from east to west is essentially a vast plain, with a sufficient slope to allow of easy drainage. The distance from Quebec to the west end of Lake Superior is about 1,200 miles, yet this lake is only 600 feet above the sea-level, while Lake Erie is 565 feet, and Lake Ontario 232 feet a bove the sea. The land on the banks of the St. Lawrence and its lakes, either near the margin, or not

very far removed, generally rises to a height of from fifty to one hundred and fifty feet, and from this level very gradually ascends to the base of the hills which bound the region.

Unlike the two regions already described, these great plains are underlaid by beds of unaltered Silurian and Devonian rocks, consisting of sandstones, limestones, and shales. These are but little disturbed, and are generally nearly horizontal; but over by far the greater part of the region they are overlaid by beds of clay, occasionally interstratified with or overlaid by sand and gravel. These superficial strata, which are in some parts several hundred feet in thickness, are throughout the eastern division, in great part of marine origin, and date from a time when this champaign region was covered by the waters of the ocean; while throughout the western division the clays are more probably of fresh-water origin. It results from the distribution of these superficial post-tertiary strata, that the soil over the greater part of the region consists of strong and heavy clays, which in the newly cleared portions are overlaid by a considerable thickness of vegetable mould. In the eastern division, a line drawn from Quebec to Ottawa, and two others from these points, converging at the outlet of Lake Champlain, will enclose a triangular area of about 9000 square miles, which is very nearly that occupied by the marine clays. These are overlaid, chiefly around the borders of this space, by more sandy deposits, which are well seen near Three Rivers, and about Sorel. They form a warm but light soil, which yields good crops when well manured, but is not of lasting fertility. The greater part of this area however is covered by a tenacious blue clay, often more or less calcareous, and of great depth, which constitutes a strong and rich soil bearing in

abundance crops of all kinds, but particularly adapted for wheat, and was in former times noted for its great fertility. These clay lands of Lower-Canada, have been for a long time under cultivation, and by repeated cropping with wheat, without fallow, rotation, deep plowing, or manure, are now in a great many cases unproductive, and are looked upon as worn out or exhausted. A scientific system of culture which should make use of deep or sub-soil ploughing, a proper rotation of crops, and a judicious application of manures, would however soon restore these lands to their original fertility. The few trials which within the last few years have been made in the vicinity of Montreal, and elsewhere, have sufficed to show that an enlightened system of tillage, with sub-soil draining, is eminently successful in restoring these lands, which offer at their present prices good inducements to skilled farmers. Besides grain and green crops, these soils are well fitted for the culture of tobacco, which is grown to some extent in the vicinity of Montreal. Notwithstanding the length of the winter season in Canada, the great heat and light of the summer, and the clearness of the atmosphere enable vegetation to make very rapid progress.

The mineral resources of this champaign region of Eastern Canada are chiefly confined to stones for building, paving, lime and cement, stone for glass-making, and peat. Large peat-bogs are very numerous in various parts of this region, and may be made to furnish an abundant supply of fuel. This part of the country is also remarkable for the great number and variety of its mineral springs.

To the northeast of Quebec, besides the plains which border the river, there is a considerable area of low-lying clay land, cut off from the great St. Lawrence basin by Laurentian hills, and occupying

the valley of Lake St. John and of a portion of the Saguenay. Here is a small outlying basin of Lower Silurian rocks, like those about Montreal, and overlaid in like manner by strong and deep clays, which extent over the adjacent and little elevated portion of the Laurentian rocks, and form a soil as well fitted for cultivation as any part of the lower St. Lawrence valley. The valley of this lake is probably not more than 300 feet above the sea; and from the sheltered position the climate is not more rigorous than that of Quebec. Several townships have within a few years been late out in this valley, and have attracted large members of French Canadians from the older parishes in the valley of St. Lawrence.

The western part of the champaign region, commencing near Kingston and including all the southern portion of the western province is the most fertile and productive part Canada. Like the plains further eastward, its soils consists chiefly of strong clays, overlaid here and there by loam, sand, and gravel. In the natural state nearly the whole of this region supported a fine growth of timber, in great part of broad-leaved species, but presented however various local peculiarities. Thus, the banks of the Grand River from Galt to Brantford were remarkable for a sparse growth of oaks, free from underwood, and known as oak openings. These are said to have been pasture grounds of the Indians, brought to this condition and kept in it by partial clearing, and by the annual burning of the grass. The object of this was to attract the deer who came to feed upon the herbage. (See on this point, Marsh's *Man and Nature*, page 137). The soil of these plains is a light sandy loam, very uniform in character, and generally underlaid by coarse gravel. Though fertile, and of an easy tillage, this and similar soils will not support the long continued

cropping without manure, which is often practiced on the clay lands of both Upper and Lower Canada.

The valley of the Thames, together with the rich alluvial flats which extend from it northward to the North Branch of Bear Creek, and southward nearly to the shore of Lake Erie, is remarkable for its great fertility, and its luxuriant forest growth. The soil is generally clay, with a covering of rich vegetable mould, and is covered in the natural state with oak, elm, black-walnut and white-wood (*Liriodendron tulipifera*) trees of large size, together with fine groves of sugar-maple. Towards the mouth of the Thames, and on the borders of Lake St. Clair is an area of natural prairie of about 30,000 acres. It lies but little above the level of the lake, and is in large part overflowed in the time of the spring floods. The soil of this prairie is a deep unctuous mould, covered chiefly with grass, with here and there copses of maple, walnut and elm, and with willows dotting the surface of the plain. Numbers of half-wild horses are pastured here, and doubtless help to keep down the forest growth. The characters of the surface are such as to suggest that it had been at no distant period reclaimed from the waters of the adjacent lake.

In no part of the province have skilled labour and capital been so extensively applied to agriculture as in western Canada, and the result is seen in a general high degree of cultivation, and in the great quantities of wheat and other grains which the region annually furnishes for exportation; as well as in the excellent grazing farms, and the quantity and quality of the dairy-produce which the region affords. This western portion of the province, from its more southern latitude, and from the proximity of the great lakes, enjoys a much milder climate than the other parts of Canada. The winters are compara-

tively short, and in the more southern sections the peach is successfully cultivated, and the chesnut grows spontaneously.

The mineral resources of this region, like those of the eastern portion of the champaign district, are comparatively few. Besides building-stones, lime, and cements, however, may be added gypsum and petroleum, both of which will be mentioned in their proper places.

It being the plan of this essay to notice in the first place those points in the natural history of the country which are connected with its agricultural interests, the supplies of artificial manures for the soil, and of peat for fuel may be here described. The building materials of the country will next be noticed, and finally the various ores and other mineral products which are the subjects of mining and manufacturing industry.

ARTIFICIAL MANURES.

In addition to the manures which are the produce of the farm, modern agriculture avails itself of various other materials which are capable of restorring to the soil the elements removed by tillage, or in other ways of promoting the growth of vegetation. Of the more common of these materials, lime and gypsum, Canada contains an abundant supply. The further notice of localities of lime, which is found almost everywhere through the province, is reserved for a subsequent page, under the head of Building Materials; but mention may here be made of the deposits of white calcareous marl, which abound in a great many lakes and marshy grounds throughout Canada, and being pure carbonate of lime, constitute a valuable manure for soils lacking this element.

GYPSUM.

Gypsum is found in great abundance for a distance of about thirty-five miles along the Grand River in western Canada, and large beds of it are opened at Cayuga, York, Seneca, Brantford, and Paris. About 14,000 tons of gypsum are annually raised from these quarries, and are for the most part consumed in that portion of the province, as a dressing for the soil. It is chiefly ground at mills in the neighbourhood, and sold in that state at from three dollars and a half to four dollars the ton, (fourteen to sixteen shillings sterling). Some of this gypsum is however pure and white, and being fitted for use as stucco, commands a higher price. These quarries are situated in the immediate vicinity of railways, which afford facilities for transportation. The gypsum consumed in Lower-Canada is chiefly brought from the Magdalene Islands in the gulf of St. Lawrence. These contain abundant deposits of this mineral, which is brought by water to Quebec and Montreal. The consumption of gypsum for agricultural purposes in Lower-Canada is however less than in the west, and might be increased with advantage.

PHOSPHATE OF LIME.

Among the most important discoveries of modern scientific agriculture is that of the value of phosphates as a manure. The beneficial effects of ground bones, and of Peruvian guano, of which last about 300,000 tons are annually brought to Great Britain, are in a great measure due to the phosphates which these manures yield to the soil; and within a few years, the use of a soluble phosphate, or superphosphate of lime as an application to the soil, has been so much extended, that its manufacture has become

a very important industry in Great Britain, France, Germany, and the United States, and has within the last few years been successfully attempted at Montreal. The phosphates employed for this purpose are bones, certain kinds of guano, and coprolites, the latter a fossil form of phosphate of lime abundant in some parts of England and France. But the supplies of these materials being limited, and the sources in many cases remote, attention has been turned to the deposits of crystalline mineral phosphate of lime (called by mineralogists apatite.) This substance is found to some extent in Norway and in Spain, and the investigations of the Geological Survey have shown that it exists in abundance among the Laurentian rocks of Canada, forming veins, which have been met with in several places along the Ottawa, and more abundantly near Perth, upon the line of the Rideau Canal. Here, over an area of many square miles, phosphate of lime has been found in a great number of localities, several of which promise to yield abundant supplies of this mineral. The attention of speculators has been turned to these deposits, which are in a locality favorable for working, and for exportation, and during the last year a New York company has expended a large sum of money in opening several veins of the phosphate, with a view to extended mining operations. This mineral phosphate is richer than the coprolites so much used in England, and contains from thirty-five to forty per cent of phosphoric acid. The working of these deposits is however undertaken solely with a view to exportation. In order to convert this mineral into superphosphate there is required a large quantity of sulphuric acid, a material which is not manufactured in the country, and can only be imported at a very considerable expense. As yet, the

value of the superphosphate as a manure is but little known in this country. Small quantities of it are however now manufactured at Montreal from bones, and the farmers of the country are beginning to learn its importance. It is to be hoped that more enlightened notions of agriculture will soon so much increase the demand for this article as to warrant the establishment of a sulphuric-acid manufactory, and the conversion into superphosphate for domestic use of a large portion of the mineral phosphates to be obtained in the province. Its employment will be one of the most efficient means of restoring the apparently exhausted wheat lands of Lower Canada.

FISH MANURE.

A most important and hitherto neglected source of valuable manure is to be found in the great fisheries of the Gulf of St.-Lawrence. The use of fish for a manure is known in many parts of the world, and there are small and inferior kinds of fish which on the coast of the United States are taken in great quantities expressly for the purpose, and either applied directly to the fields, or converted into a concentrated manure nearly equal in value to Peruvian guano. For this purpose they are cooked by steam, pressed to remove the water, and in the case of some kinds of fish, a large quantity of valuable oil, and finally dried and ground to powder.

According to Payen, an eminent French authority, the total yearly produce of the cod fisheries on the North American coast is not less than 1,500,000 tons of fresh fish. Of this, the heads and entrails, equal to one half the entire weight, are left to decay, or are thrown into the sea; but if properly would yield more

than 150,000 tons of a most valuable manure. The French fishermen have for several years had an establishment for this manufacture at Kerpon, on the coast of Newfoundland, and export the product to France. The quantity of manure of this kind which might be manufactured in Canada and the Maritime Provinces from the refuse of the fisheries, and from inferior kinds of fish which are now neglected, is very great, and this material might become a precious resource both for exportation and for the enriching of our own soils.

PEAT.

The Eastern division of the champaign region of Canada abounds in peat bogs, which are generally distributed, and cover an area approximately estimated at from 120 to 150 square miles. In addition to this the island of Anticosti contains a still greater area. In many of these bogs on the main-land the peat attains a depth of ten to twenty feet, and even more, and, especially in their deeper parts, is often so compact as to sink in water when dried; while it is at the same time very pure, yielding from four to six per cent of ash. No systematic attempts have hitherto been made to turn this material to use: but within the last few months proper arrangements have been made by an English capitalist to compress, with the aid of proper machinery, the peat of an extensive bog in Bulstrode, on the line of the Arthabaska Railway.—The success of this experiment will be a matter of very great importance for Canada. The wanton destruction of the forest in the older settled regions has made fire-wood scarce in a country whose climate renders an abundant supply of fuel indispensable, and which contains no coal-mines within its limits.

One of the chief difficulties in the extensive working of peat, arises from the obstinacy with which it retains a great amount of water. A large proportion of this must be removed by spontaneous drying, a process to which the summer climate of Canada is peculiarly favourable. According to Dr. B. H. Paul's late inquiries, it appears, that the heat-producing power of good peat is about one half that of the weight of coal. It is claimed that by proper treatment peat can be brought to the same density as coal itself; and Dr. Paul concludes that where such peat can be furnished at four shillings sterling the ton, it may advantageously replace coal at ten shillings, as a fuel for generating steam, burning bricks, etc. The price of coal in our markets is more than twice this, and it remains to be seen whether properly dried and compressed peat can be produced at two fifths the market price of coal; in which case it may replace it with advantage on our inland steamers and railways, as well as for household use. It is said to have lately been employed with success as a fuel for the locomotives on the New York Central Railway, and it is well known that peat is now largely employed for smelting iron in some parts of Germany. Viewed in the light of the foregoing considerations it can scarcely be doubted that the extensive deposits of peat which Canada contains are destined soon to become very important resources for the province.

BUILDING MATERIALS.

Among the materials of first importance to a country are those required for the purposes of building. Of these, besides the wood of the forests, may be mentioned clay for bricks, lime for mortar and cements, granites, sandstones, limestones, marbles,

and roofing-slates. The principal sources of these materials in Canada may be briefly noticed.

BRICK CLAY.

Brick clay is met with abundantly in almost every part of the great champaign region of Canada, where there are few towns of any size in the vicinity of which bricks are not manufactured. That they are not more generally used for building is due to the fact that quarries of excellent and easily wrought stone are common throughout the province. Through the western division of the champaign country, and in the westernmost parts of the eastern division, as near Brockville, there is found a clay which yields white, yellowish or cream-colored bricks, which are much esteemed for building, and are carried to Montreal and Quebec. This clay is in many parts overlaid by another, which gives red bricks. From eight to ten million are yearly made at Toronto, of which perhaps one half are white bricks. These are sold at the kilns at from $5.50 to $6.00 the thousand, (twenty-two to twenty-four shillings sterling,) while the red bricks are worth from $3.00 to $4.00. At Montreal there are several brick makers, of which the two principal ones manufacture together about 12,000,000 of red bricks, the ordinary price of which is about $5.00 the thousand.

Many of these clays are fit for coarse pottery and for tiles for agricultural draining, both of which are manufactured at numerous places throughout the province; while at Quebec glazed earthenware pipes are extensively made for street and house drains.

LIME.

Limestone fitted for burning is found in great abundance in most parts of the champaign region, as will be seen when we come to speak of building stones. The use of lime as a fertilizer for many soils is well known, and for this purpose the greater part of the limes in the province, on account of their freedom from magnesia, are well fitted. About 270,000 bushels of lime are annually burned at Montreal, where its price is about seventeen cents (eight pence half-penny sterling) the bushel. Limestone is less abundantly distributed in the mountainous districts of Canada, where however geological research has shown its presence in very many localities, especially in the Laurentian country, where bands of limestone have been already mentioned as marking the course of numerous fertile valleys. Limestones are also found in many parts of the Eastern Townships.

The property of forming a mortar which will harden under water, which belongs to hydraulic cements and water-limes, is possessed by the lime yielded by many limestones in the country, as at Quebec, at Hull on the Ottawa, at Thorold near Niagara, and at various other places in the western peninsula. Materials from these sources have been used in the construction of the extensive hydraulic works of the province.

BUILDING STONES.

The abundance of good building stones in Canada is so great that it is easier to say where they are not found than to indicate their various localities. Quebec, Montreal, Ottawa and Kingston are built of a grey limestone, which is quarried in their imme-

diate vicinity, and abounds in a great many intermediate localities, from which materials have been obtained for the canals and other public works. The stone required for the great Victoria Bridge at Montreal was in a large part procured from Pointe Claire, a few miles above the city. Limestones and dolomites of superior qualities for building purposes are met with in a great many places in the region to the west of Lake Ontario; which also yields in numerous localities a superior sandstone, of which University College, Toronto, and many other of the public buildings of that city and of Hamilton are constructed. Good sandstones for building purposes are also met with among other places at several points on the Ottawa, at Sillery near Quebec, and in the more eastern parts of the province.

In the Eastern Townships, to the east of the Notre-Dame range, there are great quantities of granite of a superior quality for building purposes, and in many parts of the Laurentian region, granite, syenite, and syenitic-gneiss rocks abound, both red and gray in colour. Some of these materials are equal to the granites of Cornwall and of Aberdeen, and would yield materials for building and for decoration of great beauty and durability; but as they are both more costly to work than the abundant limestones and sandstones, and generally more remote from the great centres of consumption, they are as yet scarcely made use of.

MARBLES.

The rocks of Canada afford a great variety of marbles. Some of the limestones of the Laurentian region afford a good white marble for building purposes and for tombstones, as at the Calumet, Portage du Fort, and Fitzroy Harbour; from which last

place marble has been obtained for the new Parliament Buildings at Ottawa. Similar white marbles are also found in Beverley, Elzevir, and Marmora. These marbles are seldom very fine grained, but from the township of Barrie, marbles of a very fine texture, both white, and colored and variegated have been obtained, through from the remoteness of the locality they have not yet been wrought. A bluish-grey veined marble, which like the preceeding is from the Laurentian region, is quarried near Arnprior on the Ottawa, and another at Grenville of mingled green and white, containing serpentine, and resembling the Connemara marble of Ireland. Similar marbles abound in many other parts of the Laurentian country, but little has as yet been done to bring these and the other marbles of the country into use.

The hills of the Eastern Townships afford many marbles of considerable beauty, as at St. Joseph and at Dudswell, the former red veined with white. At the latter place are beds of a cream colour and of grey, veined and mottled with yellow, and sometimes with black. The serpentines of the Eastern Townships are also many of them of considerable beauty, being generally dark green, often veined with lighter green and white, and resembling in some cases the famous *verd antique*, or some of the serpentines of Corsica and Cornwall. None of these materials, which abound in Melbourne, Orford, St. Joseph, and many other parts of this region, have as yet been cut, except for the purpose of exhibition; although the same serpentines are extensively quarried in the neighbouring state of Vermont, and are highly esteemed.

Many of the secondary limestones of the champaign country of Eastern Canada are susceptible of

a good polish, and present pleasing varieties of color. Good marbles, red, black, and various shades of brown and grey, often agreeably variegated, may be obtained from them in a great many places in the vicinity of Montreal, but are as yet scarcely known, although well suited for internal decoration.

Stones well fitted for flagging and paving are found in places too numerous to mention, throughout the province, but brick, and from its cheapness wood, is still to a great extent used for pavements in our towns. Paving-stones are however brought from the state of New-York and even from Scotland, while materials probably in no way inferior are to be met with in many parts of the country.

ROOFING-SLATES.

Slates for the roofing of houses have until recently been very little used in Canada, but extensive quarries in no way inferior to the best Welsh slates have within the last few years been opened in the Eastern Townships, on the line of the Grand Trunk Railway. Plates of great size and of excellent quality are here readily obtained. Similar slates are found in several other parts of the same region, and good roofing-slates have also been obtained on the north shore of lake Superior.

IRON ORES.

The ores of iron are found in very large quantities in the Laurentian rocks of Canada at several localities on the Ottawa, along the Rideau Canal, and in the vicinity of Marmora. These deposits are of the magnetic species, and less frequently, of red hematite, both of which are very rich ores, containing about 70 per cent. of metal. They are similar to those which yield the fine iron of Sweden, and

to those which are mined on the shores of Lake Champlain in New York. The absence of mineral coal in Canada would render it necessary to use wood-charcoal for the smelting, of these ores, unless as before suggested, peat be employed for the purpose. The price of labor in most parts of the country so augments the cost of charcoal that the iron smelter here finds it difficult to compete with foreign iron, and to this cause is to be attribnted the fact that the ores of Canada are not more extensively worked. The state of Michigan possesses on the southern shore of Lake Superior great deposits of red hematite ore, not unlike those of Canada, and within the last few years has exported large quantities of this ore to the vicinity of the coal mines of western Pennsylvania, where it is smelted. The value of the iron ore thus shipped is said to be at present about $2,000,000 annually, and the amount is increasing. A similar ore has lately been found in Canada, on the north shore of Lake Superior, and is about being mined by an American company for exportation to the United States. It has been attempted to send the rich ores from the Laurentian region of Canada to the American market, and it is probable that the plan may be successful, especially as some of these deposits are very advantageously placed for transportation by water.

Extensive beds of good iron ore occur in the Eastern Townships. They are iron-slates, consisting in a large part of red hematite, and although less rich than the ores already mentioned, might under favorable conditions be smelted with advantage, as has already been the case to a limited extent, the ore having been taken to Vermont.

At various localities in the champaign region of Canada considerable quantities of bog-iron ore are

found. Near to Three Rivers this ore was smelted for more than a century, and although the ancient furnaces are new abandoned, others have been established near by at Batiscan, known as the Radnor forges. The fuel here used is charcoal, and the metal produced is highly esteemed not only for castings but for the manufacture of wrought iron.

COPPER.

Veins of copper ore occur in various places in the Laurentian region, and some of them are now being opened, with what success remains to be seen. On the northeastern shore of Lake Huron, in the Huronian rocks, extensive veins of rich copper ores have been mined for several years, and in some instances with great profit, as at the Wellington Mine. The ores of copper are widely disseminated in the Eastern Townships, for the most part in the form of irregular beds and interstratified masses.—The Acton mine was one of these, which in three years yielded ores equal to about 1000 tons of copper, but is now exhausted. Numerous other attempts have been made to work copper ores in this region, and several millions of dollars have already been invested, chiefly by New-York and Boston capitalists, in the purchase of mining lands in this region; but the workings hitherto have not generally proved remunerative, although from the wide diffusion of the metal in the rocks of the district, and from the great richness of the Acton deposite, there is reason to expect that some of these mines may become sources of profit. The most extensive mining operations as yet undertaken in the Eastern Townships, are at Harvey's Hill in Leeds. Several localities in the vicinity of Sherbrooke now give promise of profitable mining.

The mines of native copper on the south side of

Lake Superior are well known, and from these the state of Michigan now exports, it is said, about $7,000,000 of copper annually, while the produce is increasing. The north or Canadian side exhibit similar rocks, containing in many places deposits of native copper like those of the south side. But although these have been known for the last twenty years, ever since indeed the first opening of the mines on the southern shore, almost nothing has been done to develope them. From the identity of the formations, and from the abundance with which the metal appears to be distributed in this part of the Canadian territory, it can scarcely be doubted that a skillful outlay of capital will yet develope on this northern shore a mining region second only to that of northern Michigan.

LEAD ORE.

Lead ore occurs in many places in the Laurentian region in the form of veins, which also appear in the eastern division of the champaign region, south of the Ottawa. Some of these veins may perhaps be wrought with advantage. Lead ore has also been met with in several localities on the shore of Gaspé, where mining operations have lately been undertaken. Small quantities of the ore have also been found in the Eastern Townships, and on Lake Superior; in both of these regions the lead is often rich in silver.

GOLD.

This precious metal has been shown to exist over a large extent of the Eastern Townships, from near the line of Vermont, in which state gold has been met with in a great many places, as far northeastward as Quebec, and it may not improbably be

found farther eastward to Gaspé, along the mountainous belt which stretches to the extremity of the province. It is from the breaking down of the rocks of this Notre-Dame range that have been derived the sands, clays, and gravel which make the soil of this belt of hills, and of the region to the east and south of them. Gold has been found in several instances in these rocks, but the attempts hitherto made to work it, have been by washing the superficial sand and gravel. These trials have in some parts been successful, and the region is now attracting skilled labour and capital, which may probably meet with profitable returns.

Among the other minerals of Canada which are capable of being turned to use, we may mention some few of the more important.

IRON PYRITES.

Iron Pyrites is found abundantly both in the Laurentian region and in the Eastern Townships, and is a material of value for the manufacture of copperas, and as a source of sulphur for the fabrication of sulphuric acid, or oil of vitriol. This substance is one of great importance to the manufacturing industry of a country, for it forms the starting point in the ordinary processes for the production of chlorine, bleaching powder, and soda-ash. Of these the latter is the indispensable material for the manufacture of soap and of glass. Sulphuric acid is moreover largely consumed for making superphosphate of lime, and for the refining of petroleum, two processes having a special interest for the province of Canada, in which the manufacture of sulphuric acid has not yet been attempted.

CHROMIUM.

Chromium in the form of chromic iron ore is another substance which is found in considerable quantities in several parts of the Eastern Townships, and is valuable as the only source of chromate of potash, which has now an extensive use in the arts for the manufacture of several pigments, and in various processes of dyeing and calico-printing.

TITANIUM.

Titanium, which has within a few years attracted the attention of iron manufacturers for its supposed beneficial influence upon iron, and has moreover been proposed for several other uses in the arts, is found in Canada in great and apparently inexhaustible quantities, as ilmenite or titanic iron ore, both in the Laurentian region and in the Eastern Townships.

Among other materials may be mentioned ores of nickel and cobalt, molybdenum, and carbonate of magnesia, all of which find their applications in a country where chemical manufactures are pursued.

OCHRES.

Ochres for paints, of great purity, and of various shades of colour are abundant in several parts of Canada, and are extensively wrought for the New-York market. In like manner sulphate of barytes, which is largely used in the preparation of pigments, is found in considerable quantities in several parts of the province.

QUARTZ.

Quartz of the purity required for glass-making is abundant in the form of white sandstone in several parts of the province, and is employed in a large

glass-factory now in successful operation near Vaudreuil, a few miles west of Montreal.

The various refractory materials required for the construction of furnaces, and for smelting metals are not wanting in Canada. In many parts of the Laurentian region PLUMBAGO or black lead is found of a superior quality for the manufacture of crucibles.

SOAPSTONE.

Soapstone which is used not only as a lining for furnaces, but in the United States for the construction of stoves for domestic purposes, abounds in the Eastern Townships; while sandstone for the hearths of furnaces, fire-clay, and moulding-sand are found in many parts of the province.

MICA.

Mica, which now finds so many applications in the arts, exists in the Laurentian region of Canada in abundance, and of an excellent quality. Thin sheets of the mineral of very large sizes are obtained, and it is already an article of export.

As materials for millstones, varieties of granite, and of hard quartzite rocks are made use of in various parts of the province; and in Grenville on the Ottawa a variety of silex precisely resembling the French buhrstone is found. Grindstones are made in many parts of western Canada from a sandstone well fitted for the purpose, while whetstones and honestones, some of them of superior quality, are found in a great many parts of the country.

Superior stones for the purpose of lithography have been found in several localities in western Canada; but although trials have shown them to be of an excellent quality, they have not yet been brought into use.

Among materials for ornamental purposes may be mentioned agates, jaspers, labrador feldspar, and porphyries. In Grenville and in Chatham are found in great abundance porphyries of fine texture, susceptible of a high polish, and of various colors, rivalling in beauty the porphyries of the old world.

PETROLEUM.

Springs of petroleum or mineral oil occur in several localities in the southwestern part of Canada; and from numerous wells sunk in Enniskillen, near Lake St. Clair, several millions of gallons were obtained in 1861–2. Since that time however the supply of oil from the wells has greatly diminished. In other localities in this region, as at Bothwell, the existence of natural springs yielding a little petroleum has led to the sinking of wells, which are yielding moderate supplies of oil. The part of the country here underlaid by the oil-bearing rock is very large, and it is not improbable that from some portions of it considerable quantities of petroleum may yet be obtained.

At the other extremity of the province, in Gaspé, natural springs yielding small amounts of petroleum are found over a considerable area, and wells are being sunk in the hopes of obtaining it in available quantities. The oil in this region occurs in Upper Silurian rocks, while in southwestern Canada it belongs to the Lower Devonian limestones. These are supposed to be the source of the wonderfully productive wells of western Pennsylvania and the adjacent regions; the estimated value of whose produce of petroleum for the current year is stated at not less than $75,000,000. Although the geological conditions have there been more favorable to the preservation and accumulation of the oil than in Canada, it is probable from the results lately obtained in Bothwell,

that wells in this region may be made to yield satisfactory returns.

The narrow limits assigned to the writer of this essay, which he has prepared at the request of the Minister of Agriculture, have permitted nothing more than a notice of some of the more important mineral resources of the province ; and the reader who may be desirous of farther information upon these subjects, and also of more detailed chemical descriptions and analyses of the soils of the country, is referred to the work already indicated as the source of the information here given, viz the GEOLOGY OF CANADA.

T. STERRY HUNT.

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